

**SNIPE BAY COPPER-NICKEL-COBALT DEPOSITS**

By Jeffrey Y. Foley

\*\*\*\*\*Field Report, December, 1989

**UNITED STATES DEPARTMENT OF THE INTERIOR**

Manuel J. Lujan, Secretary

**BUREAU OF MINES**

T S Ary, Director

# SNIFE BAY COPPER-NICKEL-COBALT DEPOSIT

## INTRODUCTION

The Snipe Bay copper-nickel-cobalt property, at the southwest end of Baranof Island in southeast Alaska, contains disseminated, massive, and semimassive sulfides of copper, nickel, cobalt, and iron in two mineralized gabbro bodies. Based on diamond drilling by Inspiration Development Company, the property is estimated to contain 94,000 short tons with 0.94 pct Cu and 0.34 pct Ni. Available cobalt assay data is insufficient for cobalt grade estimates, but limited sampling, analyses, and combinations of gravity and flotation tests by the Bureau indicate that cobalt is widespread in the Snipe Bay deposits and is recoverable. Platinum and palladium were also detected in samples collected by the Bureau in 1988.

The Bureau visited the Snipe Bay property on several occasions during the last two decades. T.L. Pittman (Mining Engineer, Alaska Field Operations Center) visited the property in 1963 and mapped the southernmost gabbro body, which had only been discovered during the preceding year. A bulk sample was collected by AFOC in 1981 for mineral characterization and preliminary flotation concentration tests by Albany Research Center (ALRC). In 1988, AFOC collected an additional five samples for further characterization and beneficiation tests by Salt Lake City Research Center (SLRC).

## LOCATION AND ACCESS

Snipe Bay is located along the densely forested southwest coast of Baranof Island, in southeast Alaska (fig. 1). The Snipe Bay deposits are between the 170- and 600-ft-elevations in a steep, south-facing gully near the mouth of Snipe Bay (fig. 2). Sitka, 45 air miles north-northwest of Snipe Bay, is the nearest supply and transportation center. A small lake ("Stol Lake"), 1.5 miles north of the deposit, has been used to land small float planes in the past, but, at least one aircraft has crashed and local pilots are not willing to attempt landings there. There are no roads in the region and because there are no safe boat- or float plane-landing sites along the rugged north shore of Snipe Bay, helicopter transport from Sitka provides the most practical access to the deposit.

## LAND STATUS

The Snipe Bay deposit is in the Tongass National Forest, administered by the National Forest Service, and is open to mineral entry, with possible restrictions as dictated by the Forest Service (Roberts, 1984). There are currently no active mining claims on the deposit.

## PROPERTY HISTORY

In 1922, four federal mining claims were located at the deposit by I. Myre Hofstad. In 1929, A.F. Buddington, of the U.S. Geological Survey was the first government geologist to examine the Snipe Bay property. In 1939, the Snipe Bay claims were acquired by S.H.P. Vevelstad, who located an additional six claims. The deposit was further examined in 1941 by J.C. Reed and G.O. Gates of the Geological Survey (Reed and Gates, 1942). During that examination, the northernmost of the two mineralized gabbro bodies was mapped and sampled. The property changed ownership several times in the next two decades and claims were maintained under various option agreements. T.L. Pittman, Bureau of Mines Mining Engineer, examined the property

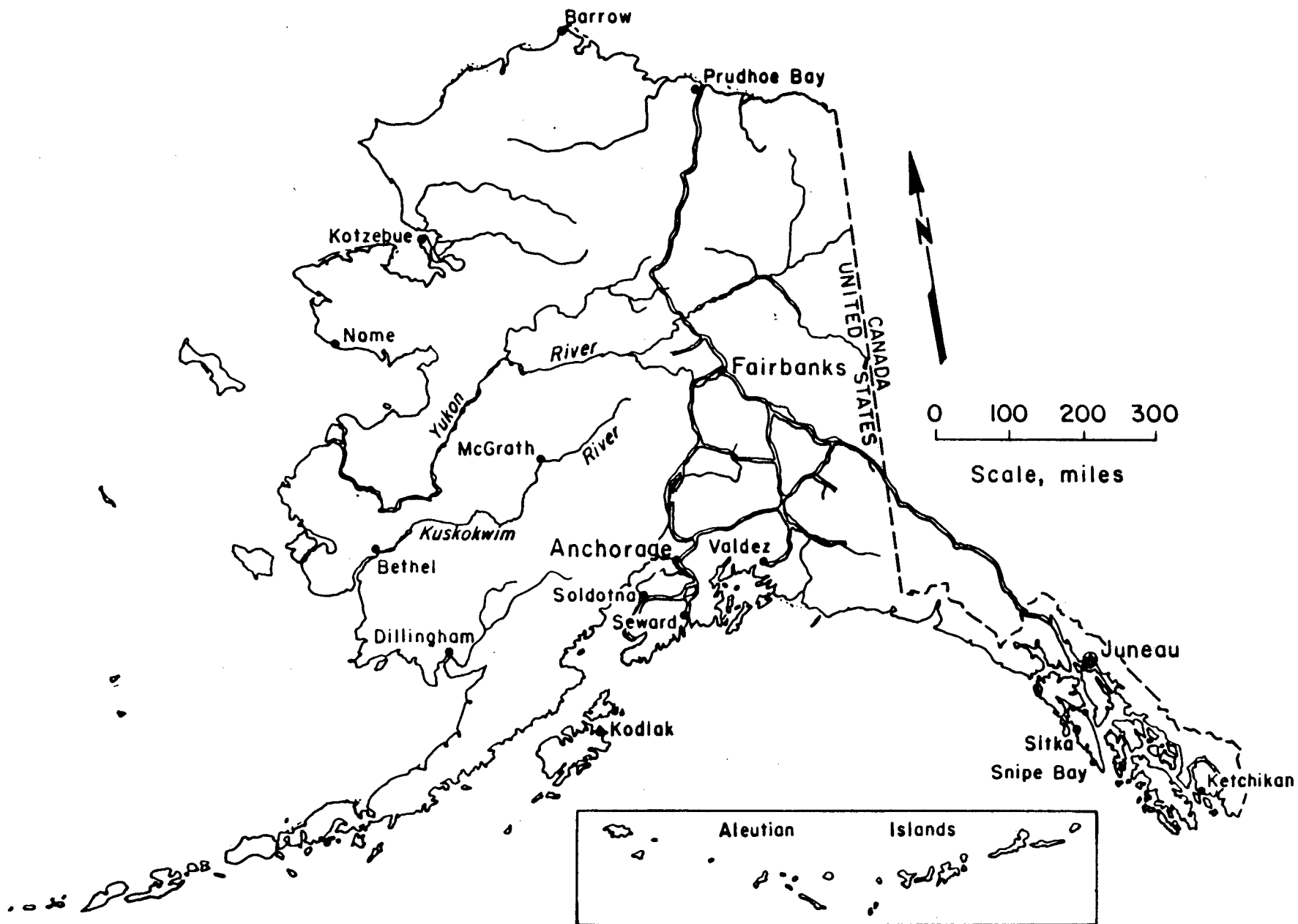


FIGURE 1. - Location map

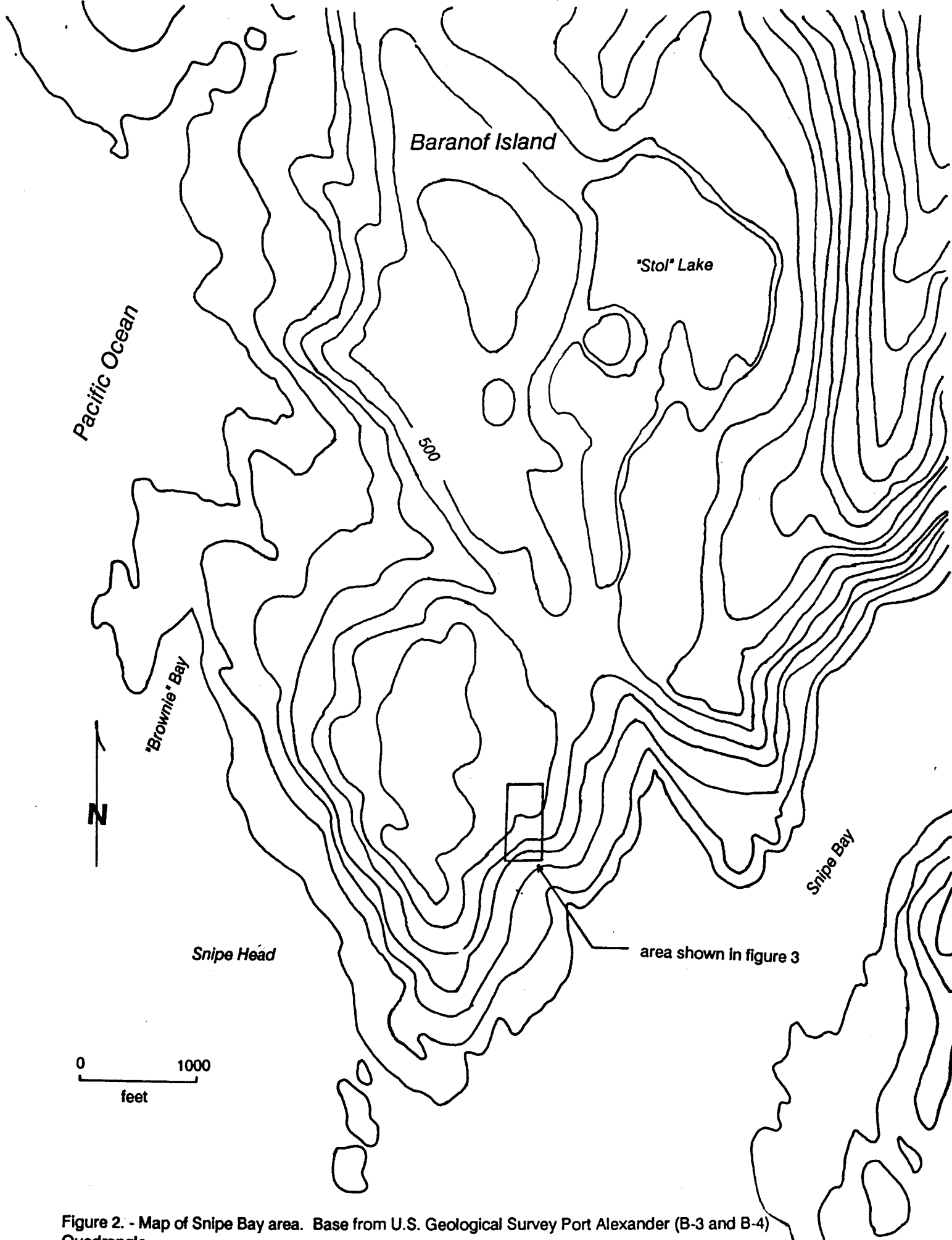


Figure 2. - Map of Snipe Bay area. Base from U.S. Geological Survey Port Alexander (B-3 and B-4) Quadrangle

in 1963, and extended geologic map coverage and sampling to cover the southern gabbro body, which was discovered in 1962 by Donald MacDonald, owner at that time. In 1973, Inspiration Development Company acquired an option on the property and located an additional 107 mining claims. Assessment work by the earlier owners consisted of clearing vegetation, trenching, and sampling; Inspiration Development Company constructed two buildings, excavated additional trenches, and delineated two mineralized gabbro bodies on the property with 21 diamond-drill holes. Assessment work was maintained on the property until 1979, when the claims were allowed to lapse by Robert M. Johnson, the most recent property owner. The buildings constructed by Inspiration Development Company were burned by the National Forest Service in 1984.

T.L. Pittman and J. Still, Bureau of Mines Mining Engineers, visited the property again in 1981 and collected a high grade, 135-lb bulk sample from an exposed sulfide mass at about the 290-ft-elevation. Mineralogical characterization and preliminary flotation tests were performed on that sample by the Bureau's Albany Research Center. Bureau of Mines Geologists, Arne Bakke and J.Y. Foley visited the property again in 1988 and collected five more samples, totalling about 400 lb, for further characterization and beneficiation tests by the Bureau's Salt Lake Research Center.

## GEOLOGY

The Snipe Bay area is underlain by the Jurassic-Cretaceous Sitka Graywacke which also underlies much of western Baranof, Kruzof, Chichagof, and Yakobi Islands. The Sitka Graywacke includes two major rock types: a massive, thick-bedded graywacke and thin- to medium-bedded, alternating and intergrading argillite and graywacke. Minor lithologies include argillite laminae, thin graywacke beds, conglomerate, and breccia. The entire sequence is several thousand feet thick and is classified as a turbidite assemblage (Loney and others, 1975). The Sitka Graywacke displays contact metamorphic aureoles and a schistose fabric where intruded by Tertiary plutons. A few miles east of Snipe Bay and elsewhere on Baranof Island, the Sitka Graywacke conformably overlies the Khaz Formation, which is assigned to the Triassic-Jurassic Kelp Bay Group. The Khaz Formation is composed of a chaotic assemblage of greenstone, greenschist, graywacke, and phyllite.

Copper-nickel-cobalt deposits occur in Tertiary gabbro, norite, and associated ultramafic intrusive rocks at Snipe Bay and several other locations in southeast Alaska, including the Brady Glacier deposit in the Crillon-La Perouse mafic complex in the Fairweather Range, Bohemia Basin and related deposits on Yakobi Island, Mirror Harbor on Chichagof Island, Fleming Island, and at Funter Bay on Admiralty Island (Buddington, 1926, Reed, 1936, Reed and Van N. Dorr, 1942, Reed and Gates, 1942, Barker, 1963, Rossman, 1963, Plafker and MacKevett, 1971, Czamanske and others, 1981, Himmelberg and Loney, 1981, Thornsbery, 1982, and Still, 1988).

At Snipe Bay, four sulfide-rich concentrations have been exposed in three trenches and one cliff exposure by past property owners; these are referred to in this report as the upper and lower north trenches, the upper south trench, and the lower south exposure. Figure 3 is adapted from brunton and tape maps constructed by Gates and Reed (1942) and Pittman (unpublished BuMines data) and shows the geology and the relative positions of these trenches. The upper and lower north trenches are in the northernmost of two altered gabbro bodies and the upper south trench and the lower south exposure are in the southernmost of the two gabbro bodies. A third, small gabbro body crops out along the beach to the south of the sulfide deposits. Sulfide-bearing gabbro float was reported by T.L. Pittman, 1.5 miles to the north of the deposit. When examined in 1988, all but the lower south trenches were mostly overgrown with vegetation, but sulfide-rich rubble was observed at the surface and the original trench-sites were readily recognizable.

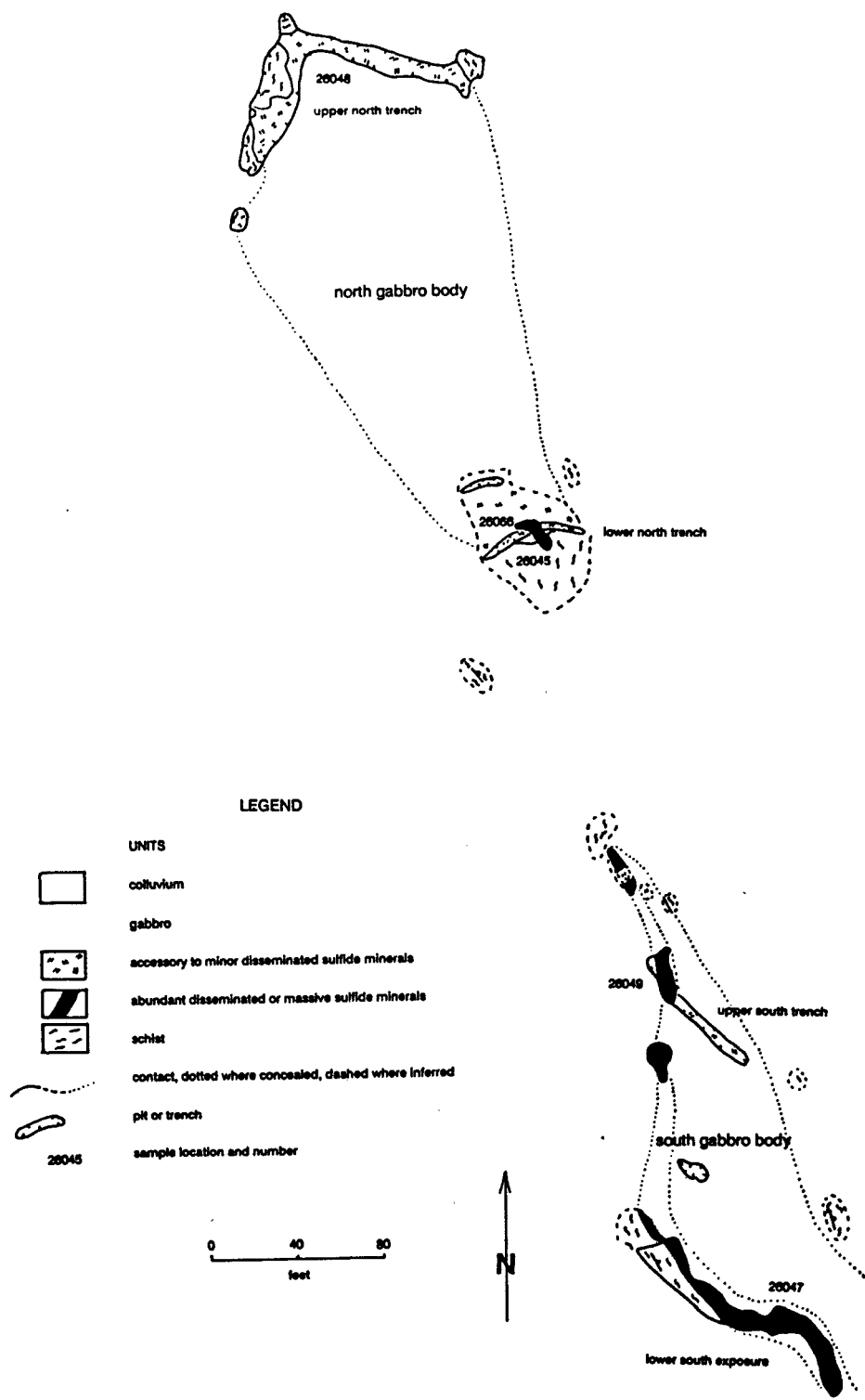


Figure 3. - Snipe Bay copper-nickel-cobalt deposits, Baranof Island, Alaska. Base map and geology adapted from Reed and Gates (1942) and Pittman (1963, unpublished).

The upper and lower gabbro bodies are both sinuous in plan view and they strike up the steep, south-facing gully on the north side of Snipe Bay. The gabbro at Snipe Bay is typically very coarse-grained and according to petrographic descriptions by Reed and Gates (1942), primary ferromagnesian silicate minerals are largely altered to brown hornblende which is in turn partially altered to pale actinolite; calcic plagioclase is altered to albite and oligoclase. Magnetite is abundant and forms between 10 and 25 pct of the rock. Apatite is reported to make up between 1 and 2 pct of the rock, and is concentrated in soda-rich feldspars. Other reported gangue minerals include ilmenite, chlorite, biotite, malachite, and iron oxides, including limonite, and goethite.

At the margins of the Snipe Bay gabbro bodies, the Sitka Graywacke has been metamorphosed to quartz-biotite schist, biotite schist, quartzite, amphibolite, and porphyroblastic cordierite schist.

## DEPOSIT DESCRIPTION

Sulfide minerals are widespread throughout the north and south gabbro bodies and are concentrated as disseminated, semimassive, and massive segregations at the four sites mentioned above. In decreasing order of abundance, sulfide minerals at Snipe Bay include pyrrhotite, chalcopyrite, pentlandite, pyrite, marcasite, and siegenite, a mineral in the linnaeite group with a composition of  $(\text{Co,Ni})_3\text{S}_4$  (Reed and Gates, 1942 and unpublished BuMines data). L.L. Brown, ALRC Geologist, reported a few grains of franklinite in a sulfide-rich sample collected from the upper south trench by J. Still. During microprobe and scanning-electron microscope examination of that sample, Mr. Brown also detected up to 4 pct cobalt in pentlandite, which rims pyrrhotite. A silver-colored mineral that resembles carrollite  $[\text{Cu}(\text{Co,Ni})_2\text{S}_4]$  (or siegenite, also in the linnaeite group), in megascopic appearance and under a hand lens, is fairly abundant in samples collected in 1988 from the upper north and lower south trenches.

Reed and Gates (1942) originally estimated the Snipe Bay deposit to contain 430,000 st with an average grade of 0.3 pct each, copper and nickel. Those estimates were based entirely on surface data. Reed and Gates estimated the gabbro body to be 256 ft long, 125 ft wide, and to extend to a depth of 135 ft beneath the lowest point of outcrop.

Diamond drilling, by Inspiration Development Company showed that the deposits do not extend to the depth inferred by Reed and Gates. Vance Thornsberry, Consulting Geologist, Spokane (WA) performed the exploration program for Inspiration Development Company. Mr. Thornsberry reports that mineralization persists to only a shallow depth where a less mafic, barren, dioritic rock containing quartz, hornblende, and possibly biotite was encountered (personal communication, December 18, 1989).

Based on the diamond drilling and magnetometer data, Mr. Thornsberry estimated the two gabbro masses to contain 94,000 short tons of mineralized rock. Total weighted grade estimates are 0.94 pct Cu and 0.34 pct Ni. The northern body is estimated to contain 51,000 short tons at 0.368 pct Cu and 0.114 pct Ni. The southern mass is estimated to contain 43,000 short tons at 1.63 pct Cu and 0.64 pct Ni.

Mr. Thornsberry also reports that a mineralized gabbro body, similar in size and character to the masses at Snipe Bay, occurs at tidewater along "Brownie Bay", in the next small inlet to the north, on the west coast of Baranof Island. Also, magnetometer and analytical data for soil samples indicate that another sulfide-bearing gabbro body occurs to the south and uphill from the small lake, 1.5 mi northeast of the Snipe Bay deposits. The latter is in the vicinity of the sulfide-bearing gabbro float reported By. T.L. Pittman.

## AFOC 1988 FIELD INVESTIGATIONS

Four days were spent at the Snipe Bay property in October, 1988. During that time, five bulk sulfide-bearing gabbro samples, several geochemical samples, and numerous specimens were collected from four trenches in sulfide-bearing gabbro. Geochemical analyses and petrographic descriptions are reported in table 1.

TABLE 1.- Geochemical analyses and descriptions for Snipe Bay samples

Sample	Element								
	As ppm	Au ppb	Co ppm	Cr ppm	Cu ppm	Ni ppm	Pd ppb	Pt ppb	V ppm
SU26045	54	11	40	419	5583	1154	4	20	539
SU26047	<5	9	593	2249	3236	10859	440	100	450
SU26048	8	4	104	373	2140	810	4	15	609

### Sample Descriptions

SU26045	Composite chip sample collected over 50-ft width at lower north trench. Semimassive and disseminated chalcopyrite, pyrrhotite, and bornite in medium- to coarse-grained altered gabbro.
SU26047	Composite chip sample collected over 100-ft width at lower south sulfide exposure. Semimassive chalcopyrite and pyrrhotite in fine-grained gabbro.
SU26048	Composite chip collected from 50-ft width at upper north trench. Disseminated pyrite, marcassite, chalcopyrite and carrollite or siegenite.

## BENEFICIATION

Sulfide flotation concentrates were produced at ALRC and SLRC on bulk samples from Snipe Bay. SLRC also performed table tests on several samples. ALRC performed flotation tests on a 135-lb, high-grade sample collected by Pittman and Still at about the 290-ft elevation. This corresponds to the elevation of the lower south sulfide exposure where disseminated and semi-massive to massive sulfides occur. The results of these tests are shown in table 2. SLRC performed flotation and gravity separation tests on 5 bulk samples, weighing from 50 to 200 lb each, from the four mineralized areas. The sample locations, grinding procedures, times, reagents, and other pertinent data are listed in tables 2-12. Tables 13 and 14 contain summary data for the flotation and tabled concentrates from all the tests.

## RECOMMENDATIONS

This report is to be forwarded to SLRC where additional beneficiation procedures are scheduled to be completed on the bulk samples collected in 1988. SLRC is planning to publish the results of those tests in a Bureau of Mines Report of Investigation.



Table 2

Sample No. ME1416-3AFOC No. 1S147Location SNIFE BAYGrind: Initial:  $-\frac{1}{4}$  in. Final: +100 mesh 0 pct. Time: 25 minutesAddition: 9.5  $\frac{\text{LB}}{\text{TON}}$  CaO -400 mesh 39 pct. Pct solids: 50

## Metallurgical Results

Product	Wt, pct.	Analysis, pct.					Analysis, oz/ton				Distribution, pct.				
		Cu	Ni	Fe	Co	S	Pt	Pd	Au	Ag	Cu	Ni	Fe	Co	S
ROUGHER CONCENTRATE	22.8	9.24	2.49	30.0	0.16	27.2	<0.001	<0.001	0.007	0.215	97.9	63.7	25.0	62.0	51.0
SCAVENGER CONCENTRATE	7.3	.20	1.74	47.7	.10	31.3	<0.001	<0.001	.004	.068	.7	14.3	12.8	12.1	18.8
FLOTATION TAILINGS	69.9	.04	.28	24.3	.02	5.2	<0.001	<0.001	.003	1.089	1.4	22.0	62.2	25.9	30.2
COMPOSITE OR TOTAL	100.0	2.15	.89	27.3	.06	12.2					100.0	100.0	100.0	100.0	100.0
HEAD		2.32	.89	29.0	.06	12.0	<0.004	<0.004	<0.008	.084					

## Test Procedure

Reagents	Condition	Rougher Flotation	Condition	Scavenger Flotation		
Potassium Amyl Xanthate	0.1 $\frac{\text{LB}}{\text{TON}}$		0.05 $\frac{\text{LB}}{\text{TON}}$			
Frother	0.05 $\frac{\text{LB}}{\text{TON}}$					
CaO	0.5 $\frac{\text{LB}}{\text{TON}}$					
pH (pre-condition = 9.3)	9.9		9.4	9.3		
Time (minutes)	1.5	4.5	1.5	3.5		

Table 3 SU 26048

SALT LAKE CITY RESEARCH CENTER

Sample Name SNipe Bay Upper North FLOTATION

SLC Sample Number AC51.3

Test Number Rm498

Date Aug 7, 1989

**Test Description:**

[illegible]

### TEST CONDITIONS

OPERATION					SCREEN ANALYSIS		
Time	GRIND	COND	RO	WATER			
Reagents (lbs/ton)	10	5	2	21			
ORE - 10 mesh	500						
WATER (DEIONIZED)	500						
A-200	.1						
EAX		.1		.1			
MISC		.1					
Machine GALIGHER	500	500	500				
RPM	1200	1000	1000				
pH	5.5						
% Solids							
Temperature							

Remarks :

Table 4 SU26045 SALT LAKE CITY RESEARCH CENTER

Sample Name Swipe Bay Lower North #1 FLOTATION

SLC Sample Number AK 51.1

Test Number RM 496

Date Aug 7, 1988

Test Description:

PRODUCT	Wgt	%	ASSAY			UNITS				DISTRIBUTION			
			Co %	Ni %	Cu %	Co	Ni	Cu		Co	Ni	Cu	
CON	40.7	8.178	.04	.43	3.6	.003271	.0352	.2244		30.81	41.27	24.23	
TAIL	457.0	91.82	.008	.055	.06	.007346	.05450	.0551		69.19	58.93	15.77	
TOTAL	497.7	100	.012	.086	.350	.010617	.0857	.3495		100	100	100	

TEST CONDITIONS

OPERATION	Grinds	Cons	R <sub>0</sub>	L <sub>0</sub> /R <sub>0</sub>								SCREEN ANALYSIS		
												Mesh	%	%
Time	10	5	2	2/2								+10		
Reagents (lbs/ton)												+14		
ORE - 10 mids	500											+20		
WATER (DEMINER)	500											+28		
H-20%	2.1											+35		
KAX		.1		.1								+48		
MISC		.1										+65		
												+100		
												+150		
												+200		
												+270		
Machine GAKICHER		500	500	500								+325		
RPM		1000	1000	1000								-325		
pH		5.5												
% Solids														
Temperature														

Remarks:



SALT LAKE CITY RESEARCH CENTER

Sample Name Santa Rosa Bay, Upper South

## FLOTATION

SLC Sample Number Ak 510

Test Number LM 500

Date Aug 28, 1914

**Test Description:**

[illegible]

## TEST CONDITIONS

[illegible]

Remarks :

Remarks :

**SALT LAKE CI. RESEARCH CENTER**  
**GRAVITY SEPARATION**

SAMPLE NAME SNIPER BAY - UPPER NORTH

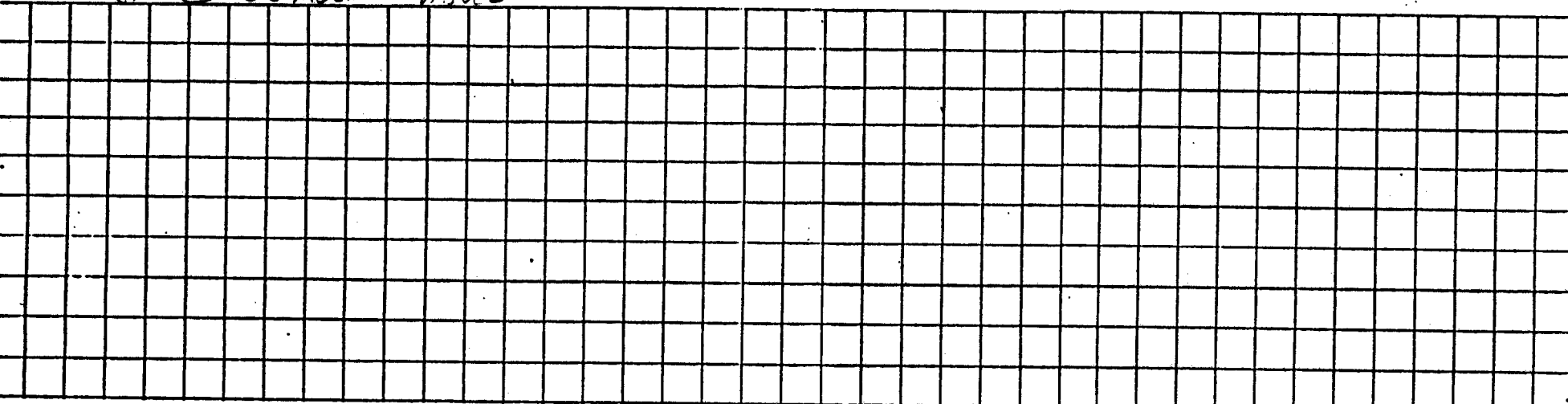
SLC SAMPLE NUMBER AK 51.3

TEST NUMBER RM-493

DATE 31 JULY 89

1000 gk @ -65 MESH - TARED

## Flowscheme

A large grid of graph paper, consisting of 20 columns and 10 rows of squares, intended for calculations.[illegible]

REMARKS:

Table 9 SN 26045

**SAMPLE NAME**

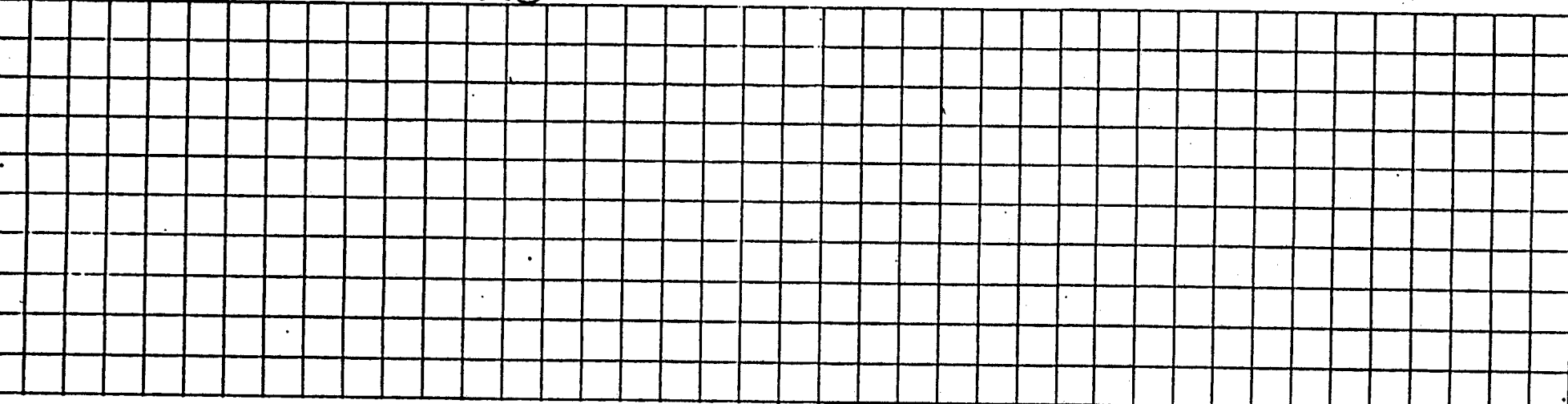
SLC SAMPLE NUMBER

**TEST NUMBER**

DATE \_\_\_\_\_

100 grams

## Flowscheme

A large grid of graph paper, consisting of 20 columns and 10 rows of squares, intended for calculations.[illegible]

REMARKS:

01001500



**SALT LAKE CI. RESEARCH CENTER**  
**GRAVITY SEPARATION**

**SAMPLE NAME**

SNIFE Bar - Lower North II

SLC SAMPLE NUMBER

Alt 51.5

**TEST NUMBER**

PLM - 495

DATE \_\_\_\_\_

31 July 89

## Flowscheme

1000 gr @ -65 MESH - TARED

[illegible]

REMARKS:

**SIGNATURE**

SN 26049 SALT LAKE CITY RESEARCH CENTER  
GRAVITY SEPARATION

DATE 21 JULY 89

## Flowscheme

1000 gr @ -65 mesh - TABLE

A large grid of graph paper with 20 columns and 10 rows. The grid is composed of small squares, with a vertical line separating the first column from the rest of the grid. The grid is empty and ready for use.[illegible]

REMARKS:

010450

**SALT LAKE CI. ) RESEARCH CENTER**  
**GRAVITY SEPARATION**

SAMPLE NAME SNIPER BAY - LOWER SOUTH

SLC SAMPLE NUMBER AK 51.2

TEST NUMBER Dm 492

DATE 31 July 89

1000 gr @ -65 mesh - TARED

## Flowscheme

[illegible]

REMARKS:

**SIGNED**

Table 13. - Flotation concentrate summary data

sample	location	concentrate	Ag oz/st	Au oz/st	Co pct	Cu pct	Fe pct	Ni pct	Pd oz/st	Pt oz/st	S pct
1S147	lower south	rougher	0.215	0.007	0.16	9.24	30.0	2.49	<0.001	<0.001	27.2
1S147	lower south	scavenger	.068	.004	.10	.20	47.7	1.74	<.001	<.001	31.3
26048	upper north	rougher			.04	1.6		.25			
26045	lower north	rougher			.04	3.6		.43			
26066	lower north	rougher			.13	4.6		2.38			
26049	upper south	rougher			.08	10.7		1.57			
26047	lower south	rougher			.07	11.4		.95			

Table 14. - Tabled concentrate summary data

sample	location	Au oz/st	Co pct	Cu pct	Ni pct	Pd oz/st	Pt oz/st	Ti pct
26048	upper north		0.3	0.2	0.047			30.1
26045	lower north		.008	.32	.037			31.0
26066	lower north		.18	4.9	3.19			5.09
26049	upper south		.015	.8	.12			29.1
26047	lower south		.016	1.9	.079			27.6

This report is also being provided to the AFOC Juneau Branch. It is recommended that that office consider additional work on the Snipe Bay, "Brownie Bay", and "Stol Lake" deposits. Such future work could be performed in conjunction with mineral resource evaluation studies in the Tongass National Forest or Chichagof Mining District. Additional information on these three areas is forthcoming from Vance Thornsberry.

Roger Burleigh, in the AFOC Fairbanks Section, who is studying advanced metals in Alaskan ore deposits may also wish to perform additional analyses on samples from the Snipe Bay, "Brownie Bay", and "Stol Lake" deposits.

Additional analytical data for gold and platinum-group metals has been requested for the gravity and flotation concentrates produced at SLRC. These data will be forwarded to the Juneau Branch upon receipt.

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